

What is claimed is:

1. A projection-type display device, comprising at least:
 - a first reflection-type image-forming means for 5 spatially modulating and reflecting an incident first illumination light to emit a first optical image,
 - a second reflection-type image-forming means for spatially modulating and reflecting an incident second illumination light to emit a second optical image,
- 10 a wavelength separation mirror for reflecting illumination light of a predetermined wavelength in incident light and emitting it as said first illumination light to said first reflection-type image-forming means and transmitting the remaining illumination light and
- 15 emitting it as said second illumination light to said second reflection-type image-forming means so as to reflect said first optical image and transmit said second optical image and emit said first and second optical images so as to follow the optical path of said incident 20 light in reverse,
- a projection optical system for projecting said first and second optical images,
- a light source for emitting predetermined light to said wavelength separation mirror as said incident 25 light, and

a light separating means for emitting said incident light emitted from said light source to said wavelength separation mirror and emitting the first and second optical images incident from said wavelength 5 separation mirror to said projection optical image.

the inclination of the wavelength separation mirror set so that the optical axis of the light incident on the wavelength separation mirror and the optical axis of the first optical image becomes smaller than 90 10 degrees.

2. A projection-type display device as set forth in claim 1, wherein:

said first reflection-type image-forming means emits said first optical image with a plane polarization 15 rotated with respect to the incident light and a polarization filter for selectively transmitting illumination light of a plane polarization corresponding to the plane polarization of said light incident on said first reflection-type image-forming 20 means is arranged between said light source and said light separating means.

3. A projection-type display device as set forth in claim 1, wherein

said first reflection-type image-forming means 25 emits said first optical image with a plane polarization

rotated with respect to the incident light and
a polarization filter for selectively
transmitting incident light of a plane polarization
corresponding to the plane polarization of said first
5 optical image is arranged between said projection optical
system and said light separating means.

4. A projection-type display device as set forth
in claim 1, wherein

10 said first reflection-type image-forming means
emits said first optical image with a plane polarization
rotated with respect to the incident light,
a first polarization filter for selectively
transmitting illumination light of a plane polarization
corresponding to the plane polarization of said light
15 incident on said first reflection-type image-forming
means is arranged between said light source and said
light separating means, and

20 a second polarization filter for selectively
transmitting incident light of a plane polarization
corresponding to the plane polarization of said first
optical image is arranged between said projection optical
system and said light separating means.

5. A projection-type display device, comprising at
least:

25 a first reflection-type image-forming means for

spatially modulating and reflecting an incident first
illumination light to emit a first optical image,
a second reflection-type image-forming means
for spatially modulating and reflecting an incident
5 second illumination light to emit a second optical image,
a third reflection-type image-forming means for
spatially modulating and reflecting an incident third
illumination light to emit a third optical image,
a first wavelength separation mirror for
10 reflecting illumination light of a predetermined
wavelength in incident light and emitting it as said
first illumination light to said first reflection-type
image-forming means and transmitting and emitting the
remaining illumination light so as to reflect said first
15 optical image and transmit said second and third optical
images and emit said first, second, and third optical
images so as to follow the optical path of the incident
light in reverse,
a second wavelength separation mirror for
20 reflecting illumination light of a predetermined
wavelength in light transmitted through said first
wavelength separation mirror and emitting it as said
second illumination light to said second reflection-type
image-forming means and transmitting the remaining
25 illumination light and emitting it as said third

illumination light to said third reflection-type image-forming means so as to reflect said second optical image and transmit said third optical image and emit said second and third optical images toward said first
5 wavelength separation mirror,

a projection optical system for projecting said first, second, and third optical images,

a light source for emitting predetermined light to said first wavelength separation mirror as said
10 incident light, and

a light separating means for emitting said incident light emitted from said light source to said first wavelength separation mirror and emitting the first, second, and third optical images incident from
15 said first wavelength separation mirror to said projection optical image,

the inclination of said first wavelength separation mirror set so that the optical axis of the light incident on said first wavelength separation mirror
20 and the optical axis of said first optical image becomes smaller than 90 degrees,

the inclination of said second wavelength separation mirror set so that the optical axis of the light incident on said second wavelength separation
25 mirror and passing through said first wavelength

separation mirror and the optical axis of said second optical image becomes smaller than 90 degrees.

6. A projection-type display device as set forth in claim 5, wherein:

5 said first reflection-type image-forming means emits said first optical image with a plane polarization rotated with respect to the incident light and
 a polarization filter for selectively transmitting illumination light of a plane polarization
10 corresponding to the plane polarization of said light incident on said first reflection-type image-forming means is arranged between said light source and said light separating means.

7. A projection-type display device as set forth in claim 5, wherein

15 said first reflection-type image-forming means emits said first optical image with a plane polarization rotated with respect to the incident light and
 a polarization filter for selectively transmitting incident light of a plane polarization
20 corresponding to the plane polarization of said first optical image is arranged between said projection optical system and said light separating means.

8. A projection-type display device as set forth in claim 5, wherein

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said first reflection-type image-forming means
emits said first optical image with a plane polarization
rotated with respect to the incident light,

a first polarization filter for selectively
5 transmitting illumination light of a plane polarization
corresponding to the plane polarization of said light
incident on said first reflection-type image-forming
means is arranged between said light source and said
light separating means, and
10 a second polarization filter for selectively
transmitting incident light of a plane polarization
corresponding to the plane polarization of said first
optical image is arranged between said projection optical
system and said light separating means.

15 9. A projection-type display device, comprising:
a reflection-type image-forming means for
spatially modulating and reflecting illumination light of
a predetermined plane polarization to emit an optical
image with a plane polarization rotated with respect to
20 the plane polarization of the illumination light,
a projection optical system for projecting said
optical image,
a light source for emitting said illumination
light, and
25 a light separating means for emitting said

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illumination light emitted from said light source toward said reflection-type image-forming means and emitting said optical image emitted from said reflection-type image-forming means to said projection optical system,

5 a polarization separation element for selectively transmitting illumination light of a plane polarization corresponding to the plane polarization of the light incident on said reflection-type image-forming means and selectively reflecting the component of the
10 plane polarization orthogonal to that plane polarization arranged between said light source and said light separating means.

10. A projection-type display device as set forth in claim 9, wherein said polarization separation element
15 is formed on an incident facet of the illumination light of said light separating means.

11. A projection-type display device, comprising:
 a reflection-type image-forming means for spatially modulating and reflecting illumination light of
20 a predetermined plane polarization to emit an optical image with a plane polarization rotated with respect to the plane polarization of the illumination light,
 a projection optical system for projecting said optical image,
25 a light source for emitting said illumination

light, and

a light separating means for emitting said illumination light emitted from said light source toward said reflection-type image-forming means and emitting
5 said optical image emitted from said reflection-type image-forming means to said projection optical system,

a polarization separation element for selectively transmitting incident light of a predetermined plane polarization corresponding to the
10 plane polarization of said optical image and selectively reflecting the component of the plane polarization orthogonal to that plane polarization arranged between said projection optical system and said light separating means.

15 12. A projection-type display device as set forth in claim 11, wherein said polarization separation element is formed on an emission facet of the optical image of said light separating means.

13. A projection-type display device, comprising:
20 a reflection-type image-forming means for spatially modulating and reflecting illumination light of a predetermined plane polarization to emit an optical image with a plane polarization rotated with respect to the plane polarization of the illumination light,
25 a projection optical system for projecting said

optical image,

a light source for emitting said illumination
light, and

a light separating means for emitting said
5 illumination light emitted from said light source toward
said reflection-type image-forming means and emitting
said optical image emitted from said reflection-type
image-forming means to said projection optical system,

a first polarization separation element for
10 selectively transmitting illumination light of a plane
polarization corresponding to the plane polarization of
the light incident on said reflection-type image-forming
means and selectively reflecting the component of the
plane polarization orthogonal to that plane polarization
15 arranged between said light source and said light
separating means,

a second polarization separation element for
selectively transmitting incident light of a
predetermined plane polarization corresponding to the
20 plane polarization of said optical image and selectively
reflecting the component of the plane polarization
orthogonal to that plane polarization arranged between
said projection optical system and said light separating
means.

25 14. A projection-type display device as set forth

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in claim 13, wherein said first polarization separation element is formed on an incident facet of the illumination light of said light separating means.

15. A projection-type display device as set forth
5 in claim 13, wherein said second polarization separation element is formed on an emission facet of the optical image of said light separating means.

16. A projection-type display device as set forth
in claim 13, wherein

10 said first polarization separation element is formed on an incident facet of the illumination light of said light separating means, and

 said second polarization separation element is formed on an emission facet of the optical image of said
15 light separating means.

17. A projection-type display device, comprising:
 a reflection-type image-forming means for spatially modulating illumination light of a predetermined plane polarization to emit an optical image
20 with a plane polarization rotated with respect to the plane polarization of the illumination light,

 a projection optical system for projecting said optical image,

 a light source for emitting said illumination
25 light, and

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a polarization beam splitter for emitting said illumination light emitted from said light source toward said reflection-type image-forming means and emitting a predetermined polarization component in the optical light
5 incident from said reflection-type image-forming means to said projection optical system,

said polarization beam splitter being formed by a member satisfying the following relationship:

$$10 \quad 5.00 \times 10^2 \geq K \cdot \alpha \cdot E \cdot \frac{C_p}{\rho} \int_{\lambda_2}^{\lambda_1} (1-T) d\lambda$$

where, K: photoelasticity constant of said member (nm/mm²/N),

α : linear expansion coefficient of said member (10⁻⁶/K),

15 E: Young's modulus of said member (10³N/mm²),

λ : wavelength of the illumination light (nm),

T: internal transmittance of said member at the wavelength λ ,

ρ : specific gravity of said member (g/cm³), and

20 C_p: specific heat of said member (J/g·k),

the integration range in Equation being a range of the light absorption wavelength band of the member.

18. A projection-type display device as set forth in claim 17, wherein said light absorption wavelength

band is a range of 420 nm to 500 nm.

19. A projection-type display device as set forth
in claim 17, wherein a polarization separation element
for selectively transmitting illumination light of a
5 plane polarization corresponding to the plane
polarization of the light incident on said reflection-
type image-forming means and selectively reflecting the
component of the plane polarization orthogonal to that
plane polarization arranged between said light source and
10 said polarization beam splitter.

20. A projection-type display device as set forth
in claim 19, wherein said polarization separation element
is formed on an incident facet of the illumination light
of said polarization beam splitter.

15 21. A projection-type display device as set forth
in claim 17, wherein a polarization separation element
for selectively transmitting incident light of a
predetermined plane polarization corresponding to the
plane polarization of said optical image and selectively
reflecting the component of the plane polarization
20 orthogonal to that plane polarization arranged between
said projection optical system and said polarization beam
splitter.

22. A projection-type display device as set forth
25 in claim 21, wherein

said polarization separation element is formed
on an emission facet of the optical image of said
polarization beam splitter.

23. A projection-type display device as set forth
5 in claim 17, wherein

a first polarization separation element for selectively transmitting illumination light of a plane polarization corresponding to the plane polarization of the light incident on said reflection-type image-forming means and selectively reflecting the component of the plane polarization orthogonal to that plane polarization arranged between said light source and said polarization beam splitter and

a second polarization separation element for
15 selectively transmitting incident light of a predetermined plane polarization corresponding to the plane polarization of said optical image and selectively reflecting the component of the plane polarization orthogonal to that plane polarization arranged between
20 said projection optical system and said polarization beam splitter.

24. A projection-type display device as set forth
in claim 23, wherein said first polarization separation
element formed on to an incident facet of the
25 illumination light of said polarization beam splitter.

25. A projection-type display device as set forth in claim 23, wherein said second polarization separation element is formed on an emission facet of the optical image of said polarization beam splitter.

5 26. A projection-type display device as set forth in claim 23, wherein

said first polarization separation element is formed on an incident facet of the illumination light of said polarization beam splitter and

10 27. A projection-type display device, comprising:
said second polarization separation element is formed on an emission facet of the optical image of said polarization beam splitter.

27. A projection-type display device, comprising:
a plurality of reflection-type image-forming
15 means each of which for spatially modulating incident light of a predetermined wavelength and emitting an optical image with a plane polarization rotated with respect to the plane polarization of the incident light,

20 a light source for emitting illumination light,
a dichroic prism for emitting illumination light emitted from said light source to said plurality of reflection-type image-forming means based on wavelength and emitting said optical images incident from said plurality of reflection-type image-forming means so as to
25 run in reverse along the optical axis of said

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illumination light,

a projection optical system for projecting said optical images, and

a polarization beam splitter for emitting said 5 illumination light emitted from said light source toward said dichroic prism and emitting a predetermined polarization component in said optical images incident from said dichroic prism to said projection optical system,

10 said polarization beam splitter and/or said dichroic prism being formed by a member satisfying the following relationship:

$$5.00 \times 10^2 \geq K \cdot \alpha \cdot E \cdot \frac{C_p}{\rho} \int_{\lambda_2}^{\lambda_1} (1-T) d\lambda$$

15 where, K: photoelasticity constant of said member (nm/mm²/N),

α : linear expansion coefficient of said member ($10^{-6}/K$),

E: Young's modulus of said member ($10^3 N/mm^2$),

20 λ : wavelength of the illumination light (nm),

T: internal transmittance of said member at the wavelength λ ,

ρ : specific gravity of said member (g/cm^3), and

C_p: specific heat of said member ($J/g \cdot K$),

the integration range in Equation being a range of the light absorption wavelength band of the member.

28. A projection-type display device as set forth in claim 27, wherein said light absorption wavelength
5 band is a range of 420 nm to 500 nm.

29. A projection-type display device as set forth in claim 27, wherein a polarization separation element for selectively transmitting illumination light of a plane polarization corresponding to the plane
10 polarization of the light incident on said reflection-type image-forming means and selectively reflecting the component of the plane polarization orthogonal to that plane polarization arranged between said light source and said polarization beam splitter.

15 30. A projection-type display device as set forth in claim 29, wherein said polarization separation element is formed on an incident facet of the illumination light of said polarization beam splitter.

31. A projection-type display device as set forth
20 in claim 27, wherein a polarization separation element for selectively transmitting incident light of a predetermined plane polarization corresponding to the plane polarization of said optical image and selectively reflecting the component of the plane polarization
25 orthogonal to that plane polarization arranged between

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said projection optical system and said polarization beam splitter.

32. A projection-type display device as set forth in claim 31, wherein

5 said polarization separation element is formed on an emission facet of the optical image of said polarization beam splitter.

33. A projection-type display device as set forth in claim 27, wherein

10 a first polarization separation element for selectively transmitting illumination light of a plane polarization corresponding to the plane polarization of the light incident on said reflection-type image-forming means and selectively reflecting the component of the 15 plane polarization orthogonal to that plane polarization arranged between said light source and said polarization beam splitter and

 a second polarization separation element for selectively transmitting incident light of a 20 predetermined plane polarization corresponding to the plane polarization of said optical image and selectively reflecting the component of the plane polarization orthogonal to that plane polarization arranged between said projection optical system and said polarization beam 25 splitter.

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34. A projection-type display device as set forth
in claim 33, wherein said first polarization separation
element is formed on an incident facet of the
illumination light of said polarization beam splitter.

5 35. A projection-type display device as set forth
in claim 33, wherein said second polarization separation
element is formed on an emission facet of the optical
image of said polarization beam splitter.

10 36. A projection-type display device as set forth
in claim 33, wherein

 said first polarization separation element is
formed on an incident facet of the illumination light of
said polarization beam splitter and

 said second polarization separation element is
15 formed on an emission facet of the optical image of said
polarization beam splitter.